

Geometry 3-3 Study Guide Proving Lines Parallel (pp 162-165)

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Attendance Problems. Write the converse of each statement.

1. If $a = b$, then $a + c = b + c$.
2. If $m\angle A + m\angle B = 90^\circ$, then $\angle A$ & $\angle B$ are complementary.
3. If $AB + BC = AC$, then A , B , and C are collinear.

I can use the angles formed by a transversal to prove two lines are parallel.

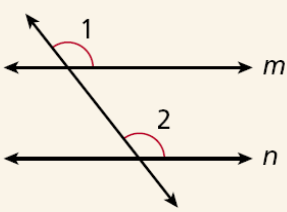
Common Core

- **CC.9-12.G.CO.9** Prove geometric theorems about lines and angles.
- **CC.9-12.G.CO.12** Make formal geometric constructions with a variety of tools and methods.

Recall that the converse of a theorem is found by exchanging the hypothesis and conclusion. The converse of a theorem is not automatically true. If it is true, it must be stated as a postulate or proved as a separate theorem.

Postulate 3-3-1

Converse of the Corresponding Angles Postulate

THEOREM	HYPOTHESIS	CONCLUSION
If two coplanar lines are cut by a transversal so that a pair of corresponding angles are congruent, then the two lines are parallel.	$\angle 1 \cong \angle 2$ 	$m \parallel n$

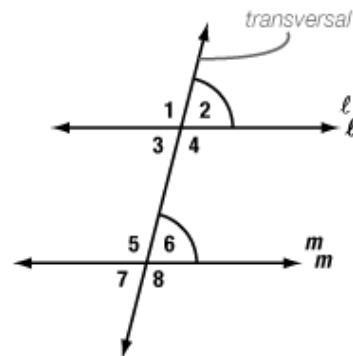
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Video Example 1.

A. Given: $\angle 2$ congruent $\angle 6$

Prove: $l \parallel m$

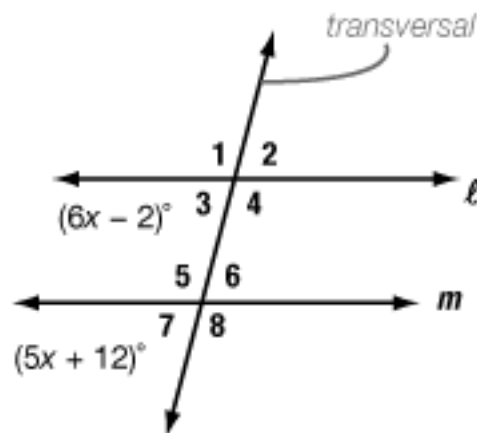


B. Given: $m\angle 3 = (6x - 2)^\circ$

$m\angle 7 = (5x + 12)^\circ$

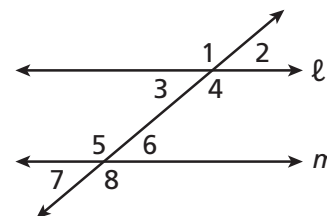
$x = 14$

Prove: $l \parallel m$



1 Using the Converse of the Corresponding Angles Postulate

Use the Converse of the Corresponding Angles Postulate and the given information to show that $\ell \parallel m$.

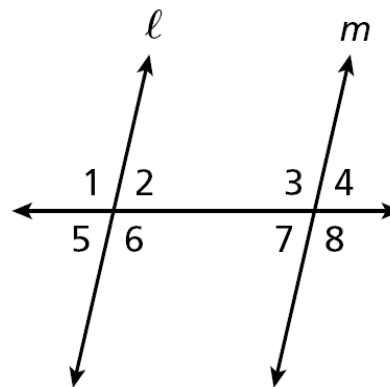


A $\angle 1 \cong \angle 5$
 $\angle 1 \cong \angle 5$ $\angle 1$ and $\angle 5$ are corresponding angles.
 $\ell \parallel m$ Conv. of Corr. \angle s Post.

B $m\angle 4 = (2x + 10)^\circ$, $m\angle 8 = (3x - 55)^\circ$, $x = 65$
 $m\angle 4 = 2(65) + 10 = 140$ Substitute 65 for x .
 $m\angle 8 = 3(65) - 55 = 140$ Substitute 65 for x .
 $m\angle 4 = m\angle 8$ Trans. Prop. of Equality
 $\angle 4 \cong \angle 8$ Def. of \cong
 $\ell \parallel m$ Conv. of Corr. \angle s Post.

Guided Practice. Use the Converse of the Corresponding Angles Postulate and the given information to show that $\ell \parallel m$.

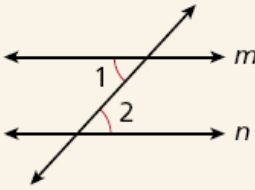
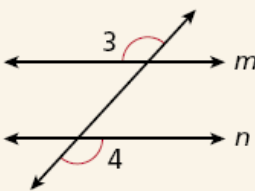
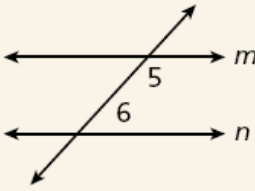
4. $m\angle 1 = m\angle 3$



5. $m\angle 7 = (4x + 25)^\circ$
 $m\angle 5 = (5x + 12)^\circ$, $x = 13$

Postulate 3-3-2 Parallel Postulate

Through a point P not on line ℓ , there is exactly one line parallel to ℓ .

Theorems Proving Lines Parallel		
THEOREM	HYPOTHESIS	CONCLUSION
3-3-3 Converse of the Alternate Interior Angles Theorem If two coplanar lines are cut by a transversal so that a pair of alternate interior angles are congruent, then the two lines are parallel.	$\angle 1 \cong \angle 2$ 	$m \parallel n$
3-3-4 Converse of the Alternate Exterior Angles Theorem If two coplanar lines are cut by a transversal so that a pair of alternate exterior angles are congruent, then the two lines are parallel.	$\angle 3 \cong \angle 4$ 	$m \parallel n$
3-3-5 Converse of the Same-Side Interior Angles Theorem If two coplanar lines are cut by a transversal so that a pair of same-side interior angles are supplementary, then the two lines are parallel.	$m\angle 5 + m\angle 6 = 180^\circ$ 	$m \parallel n$

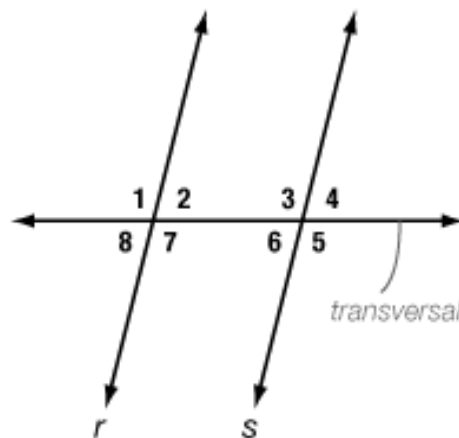
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Video Example 2. Refer to the diagram. Use the given information and the theorems you have learned to show that $r \parallel s$.

4. $m\angle 4 = m\angle 8$

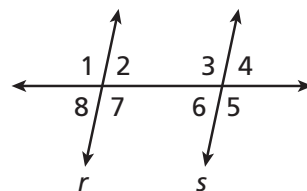
5. $m\angle 3 = (4x + 2)^\circ$, $m\angle 2 = (8x - 2)^\circ$, and $x = 15$.



2 Determining Whether Lines are Parallel

Use the given information and the theorems you have learned to show that $r \parallel s$.

A $\angle 2 \cong \angle 6$
 $\angle 2 \cong \angle 6$ $\angle 2$ and $\angle 6$ are alternate interior angles.
 $r \parallel s$ Conv. of Alt. Int. \angle Thm.



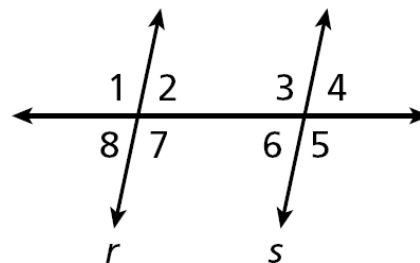
B $m\angle 6 = (6x + 18)^\circ$, $m\angle 7 = (9x + 12)^\circ$, $x = 10$
 $m\angle 6 = 6x + 18$
 $\quad = 6(10) + 18 = 78^\circ$ Substitute 10 for x .
 $m\angle 7 = 9x + 12$
 $\quad = 9(10) + 12 = 102^\circ$ Substitute 10 for x .
 $m\angle 6 + m\angle 7 = 78^\circ + 102^\circ$
 $\quad = 180^\circ$ $\angle 6$ and $\angle 7$ are same-side interior angles.
 $r \parallel s$ Conv. of Same-Side Int. \angle Thm.

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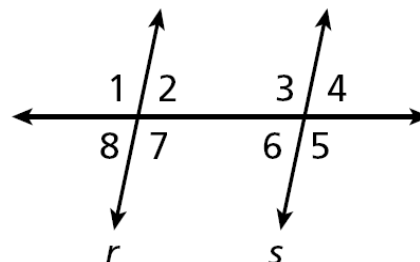
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Example 2. Refer to the diagram. Use the given information and the theorems you have learned to show that $r \parallel s$.

A. $m\angle 4 = m\angle 8$



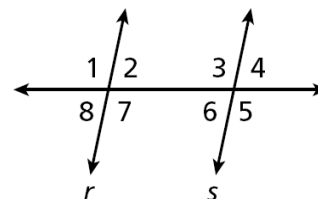
B. $m\angle 2 = (10x + 8)^\circ$, $m\angle 3 = (25x - 3)^\circ$, $x = 5$



Guided Practice. Refer to the diagram. Use the given information and the theorems you have learned to show that $r \parallel s$.

6. $m\angle 4 = m\angle 8$

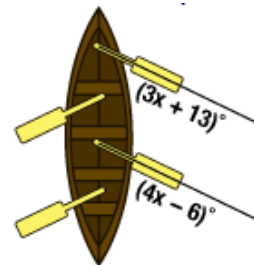
7. $m\angle 3 = 2x^\circ$
 $m\angle 7 = (x + 50)^\circ$
 $x = 50$.



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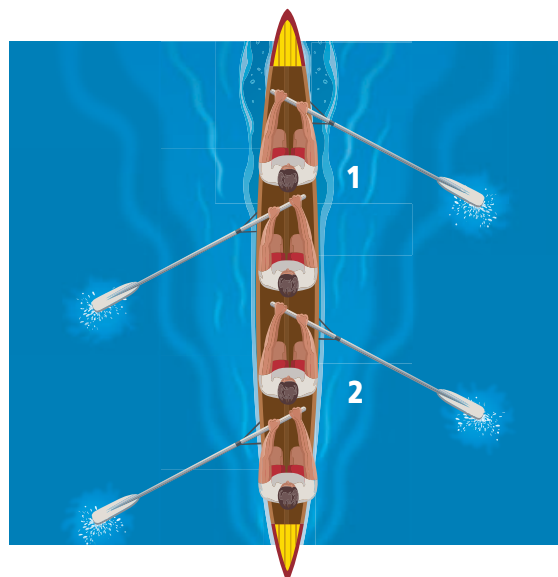
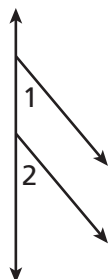
Video Example 4. During a race, all members of a rowing team should keep the oars parallel on each side. If $m\angle 1 = (3x + 13)^\circ$, $m\angle 2 = (4x - 6)^\circ$, and $x = 19$, show that the oars are parallel.



4 Sports Application

During a race, all members of a rowing team should keep the oars parallel on each side. If $m\angle 1 = (3x + 13)^\circ$, $m\angle 2 = (5x - 5)^\circ$, and $x = 9$, show that the oars are parallel.

A line through the center of the boat forms a transversal to the two oars on each side of the boat.



$\angle 1$ and $\angle 2$ are corresponding angles.
If $\angle 1 \cong \angle 2$, then the oars are parallel.

Substitute 9 for x in each expression:

$$m\angle 1 = 3x + 13$$

$$= 3(9) + 13 = 40^\circ \quad \text{Substitute 9 for } x \text{ in each expression.}$$

$$m\angle 2 = 5x - 5$$

$$= 5(9) - 5 = 40^\circ \quad m\angle 1 = m\angle 2, \text{ so } \angle 1 \cong \angle 2.$$

The corresponding angles are congruent, so the oars are parallel by the Converse of the Corresponding Angles Postulate.

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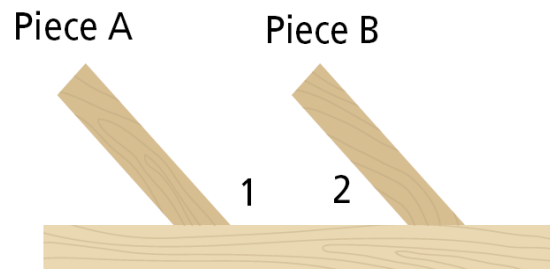
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Example 4.

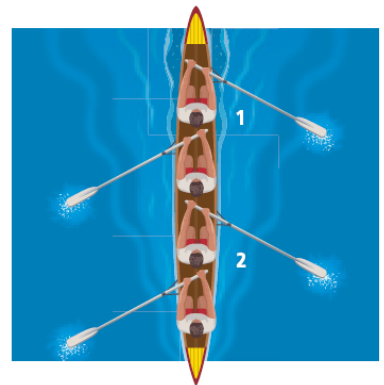
A carpenter is creating a woodwork pattern and wants two long pieces to be parallel.

$m\angle 1 = (8x + 20)^\circ$ and $m\angle 2 = (2x + 10)^\circ$. If

$x = 15$, show that pieces A and B are parallel.



9. Guided Practice. Suppose the corresponding angles on the opposite side of the boat measure $(4y - 2)^\circ$ and $(3y + 6)^\circ$, where $y = 8$. Show that the oars are parallel.



3-3 Proving Lines Parallel (pp 166) 13, 15, 19, 21, 28, 29, 33, 34, 35, 37a, 41, 42.